DOCUMENT RESUME

ED 419 958 CE 076 642

AUTHOR Athanasou, James A.
TITLE Evaluating the Effectiveness of Multimedia Based Learning. Occasional Paper Number 5.
PUB DATE 1998-07-00
NOTE 13p.; Paper presented at the International Conference on Quality and Productivity Centre (Singapore, July 1998).
PUB TYPE Reports - Research (143) -- Speeches/Meeting Papers (150)
EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS Adult Education; Educational Quality; Evaluation Methods; Foreign Countries; *Holistic Approach; Instructional Effectiveness; Models; *Multimedia Instruction; Program Evaluation; Synthesis
IDENTIFIERS *Australia

ABSTRACT

A holistic approach to evaluating an adult education and training program or service was proposed that is based on consideration of the following: ethics, objectives, stakeholders, coverage, effects, and costs. According to the proposed approach, the following are among the design features of multimedia instruction to be considered before an evaluation: particular mode of technology-assisted learning; method of using technology in the instructional process; social aspects of the instructional process; relationship with other components of training/instruction; hardware requirements; software aspects; assumed learning sequences; medium of presentation of details; extent of interactivity, self-pacing, and self-direction; and subject matter interest. The actual evaluation procedure is a six-step process during which evaluators evaluate a program against the prescribed criteria to ascertain the following: whether the program or service is ethical; the extent to which the program or service covers those who are most in need; the costs, benefits, and utilities of the program or service; whether the program or service achieved its key objective(s); the net effect of the program or service; and the extent to which the perspectives and interests of all stakeholders have been considered and met. (24 endnotes) (MN)

****
* Reproductions supplied by EDRS are the best that can be made *
* from the original document. *
****

ED 419 958

OCCASIONAL PAPER
Number 5

EVALUATING THE EFFECTIVENESS OF MULTIMEDIA BASED LEARNING

James A Athanasou
Faculty of Education
University of Technology, Sydney

U.S. DEPARTMENT OF EDUCATION
Office of Educational Research and Improvement
EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

- This document has been reproduced as received from the person or organization originating it.
- Minor changes have been made to improve reproduction quality.

- Points of view or opinions stated in this document do not necessarily represent official OERI position or policy.

PERMISSION TO REPRODUCE AND DISSEMINATE THIS MATERIAL HAS BEEN GRANTED BY

J Athanasou

TO THE EDUCATIONAL RESOURCES INFORMATION CENTER (ERIC)

July 1998

CE076442

EVALUATING THE EFFECTIVENESS OF MULTIMEDIA BASED LEARNING

James A Athanasou
Faculty of Education
University of Technology, Sydney

There are major paradigm shifts occurring in the delivery of formal instruction with new pathways and options for learning at all stages of human development. Typical of these developments are: (a) the Ford factory in Cologne, which uses flexible learning through tutorials, simulations, hypermedia to assist workers obtain vocational qualifications[1]; or (b) using optical disk-based technology for delivering courseware in the learning of cell biology[2]; or (c)Telescopia, a technology-driven European Union project for distance learning[3]; or (d) Just in time Open Learning which combines computer-mediated communications with a hypermedia database[4]; or (e) the introduction of open and flexible learning in three British Training and Enterprise Councils, which reduced unit costs by 10-50%.[5] Such innovations, when coupled with the power of multimedia based learning, have major implications for educational evaluation.

Although we may pride ourselves on the ability to act rationally, it is not always the case that our educational programs or training services are reviewed objectively or adequately. For instance, despite the fact that Australian training expenditure in 1996 accounted for some 2.5% of gross wages, only 28.6% of in-house courses had their content and subject matter decided on the basis of earlier course evaluations or even a formal training needs analysis (32%)[6] Yet at the same time there are many trainers who wish to be self-critical and are conscious of the need for formal evaluations. Accordingly, one of the most frequently asked questions that I encounter is: 'How should I evaluate industrial and commercial training?'

Paper presented at the International Quality & Productivity Centre Conference, July 1998, Singapore

Unfortunately there is a common view that almost any educational program is beneficial. Well it might be but it will be more certain when we choose to compare it to another program or to a set of standards. By way of introduction, let me cite examples from widely divergent fields to further emphasise the need for evaluation as a component of all learning programs: health services training; computer-based instruction; classroom instruction; and management in commerce and industry.

Over the last 10 years Congress provided nearly $(A) 2.6 billion for health professions training, including nurses, nurse practitioners and nurse midwives. Six of the 23 programs had never been evaluated and the evaluations of the remaining 17 were unable to be generalised beyond their locality to determine any national impact[7]. This scenario is not atypical. A major Australian banking corporation introduced training through an interactive CD-ROM package (which typically requires about 600 hours of development/production time). It was designed to provide flexible learning throughout its branch network on the basis of reducing the travel costs associated with staff training. The costly computer-based instruction was not evaluated by the developers (other than software testing) because it was considered to be effective but independent assessments indicated no reduction in face-to-face instruction, an outright preference for using written manuals of instruction and in many cases the CD-ROM package was not even tried. Thirdly, comparisons of computer-assisted instruction versus conventional teaching on 5,379 Job Corps trainees[3] found small achievement gains even after some 60 hours of instruction. Such comparisons are a useful start but they are fraught with difficulties because we know that both learner background (e.g., prior knowledge, interest) as well as instructional characteristics (e.g., design, level of control, navigation) affect the evaluation of multimedia learning[9] Fourthly, an estimated $(A) 40 billion is spent in the US on management training, yet a recent survey indicated that this was not being evaluated. It is not the case that trainers are reluctant to evaluate but what are some of the barriers? Some of the reasons centred on a lack of standards, the difficulty in measuring learning, insufficient staff, difficulties in quantifying or measuring evaluations, as well as a lack of expertise in evaluation methods.[10]

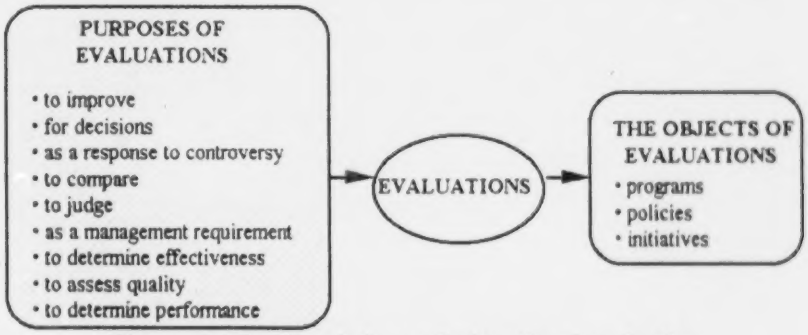


Figure 1. The foundations of educational evaluation

Evaluation as a way of deciding worth and merit

The introduction of any technology-assisted learning program or service reflects a personal, social and organisational investment that needs to be reviewed. How can one be a professional if there is no built-in monitoring or some form of program evaluation? Without this, we can end up with 'sloppy thinking', with poor judgements about the efficacy of our services and below average performance.

Evaluation can serve as a useful component of all programs and services, ideally in a formative sense to make amendments and improvements as well as a general monitoring role. The Joint Committee on Standards for Educational Evaluation defines the way in which I am using the term evaluation, namely, as 'the systematic investigation of the worth or merit of an object'[11].

In a field such as education or training, which has a proud tradition of theory and practice, there could be nothing more consistent with professionalism than to mandate the evaluation of major programs and services, especially technology-assisted learning because of its potential to change ways of learning and instruction. Evaluation was developed largely

by educators and has an applied emphasis. It has been refined over many years to become a separate discipline and area of study in its own right, growing from developments in social science research methodologies and the healthy respect that we have for evidence and facts.

For the purposes of this paper I am concerned with public, structured, formal and summative evaluations and I shall focus on the key steps for evaluating a program or service, mainly in the area of adult education and training[12]. The aim of this paper is to outline a holistic or synthetic approach that you can use to evaluate training and educational programs (see figure). I do not dwell on the specific plans or procedures (ie, methodology) but focus on six key issues.

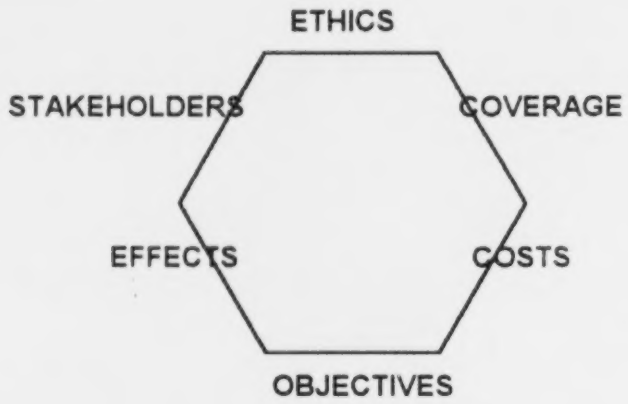


Figure 2. The ECCOES framework for evaluations

Where available I shall refer to examples from technology-assisted learning and at the outset I wish to state that I do not represent any particular program, product or service. I deal mainly with computer-assisted learning[13] as part of a case study for evaluation even though this is only one aspect of multimedia learning. Some of the examples that I am using will come from other fields of education and training but the ideas can readily be transferred to all areas of multimedia learning within industrial and commercial training (see also the table below dealing with design features).

SOME DESIGN FEATURES OF MULTIMEDIA LEARNING TO BE CONSIDERED PRIOR TO AN EVALUATION

- The particular mode of technology-assisted learning
- Method of use of technology in the instructional process
- Social aspects of the instructional process
- Relationship with the other components of training/instruction
- Hardware requirements
- Sound, image quality
- Software aspects – ease of use, errors
- The assumed learning sequences
- Medium of presentation of details
- Extent of interactivity, self-pacing and self-direction
- Subject matter interest

Steps in an evaluation of an education or training program

Let me now direct your attention to the criteria that I think should be used in an evaluation. An attempt has been made to provide you with a framework and a structure for your decision making. Six steps are listed and I have called this a holistic (or synthetic) approach to evaluation. It is up to you, however, to decide how to combine the answers to

these six bits of information in deciding upon the merit or worthiness of any program or service (ie, technology-assisted learning).

Step 1 - Is the program or service ethical?

This is the first and foremost question prior to any program evaluation. It takes into account, questions such as:

- Ethics/morality,
- Social and political implications,
- Legality,
- Any harmful ecological issues,
- Any impact on privacy or confidentiality,
- Any abuse of privilege, and
- Whether human ethical guidelines have been satisfied.

I would not presume to tell you what is appropriate but your own professional and ethical codes might serve as a guide. You may wish to question the ways in which the technology is applied to learning or the rationale for the introduction of technology-assisted learning. The latter should probably involve valid social, economic, vocational or pedagogic reasons.

Step 2 - To what extent does the programs or services cover those who are most in need?

The second issue here is the coverage of the program (eg, coverage efficiency, specificity, and sensitivity). While it is important to establish that large numbers of people are capable of being served it is also important to relate it to questions of:

- The incidence[14] of the educational or training need,
- The prevalence of the educational or training need,
- The numbers of people who are at risk
- The sensitivity of the program
- The specificity of the education or training
- The attendance and completion rates for any course.

A helpful calculation is to determine the coverage efficiency[15] of a program.

$$\text{Coverage efficiency} = 100 \times \left(\frac{\text{Number in need served}}{\text{Total number in need}} - \frac{\text{Number not-in-need served}}{\text{Total number served}} \right)$$

An example, would be an organisation with 150 staff that was trained in new techniques but 25 already had the required skills. The coverage efficiency of this training program involving face-to-face instruction was a minus 80% (125/125 – 25/150).

Step 3 - What are the costs, benefits and utilities of the program or service?

Most education and training programs are labour intensive in delivery and not always as cost-effective as we would like them to be. My initial estimates of the general break-even cost of tertiary level face-to-face classroom instruction or training (without additional resources) is around $35 per person per hour or around $525 per hour for a group of 15 (not inclusive of participant salaries or wages) or around $14,000 per group for many semester length units or modules. This can compare favourably with more flexible forms of delivery where the bulk of the costs are transferred to the production stages rather than to delivery. It can be useful to consider the ratio of production time to delivery or learning; in the area of computer-assisted learning the ratio of production time to one hour of instruction has varied from 30 to as much as 1,000 hours. Nevertheless, the available evidence indicates that the overall reduction in instructional time for computer-assisted learning has averaged out at around one-third.

It is a helpful first step to take into account all the likely costs associated with the production and delivery of a program. These include salaries, on-costs, participant wages, rental and all the other overheads that would be required if the program was to be developed or offered independently or externally. Many of our development and delivery costs are "buried" and the real expenses are hardly ever considered.

Various cost-benefit analyses allow us to compare different alternatives when their inputs and outcomes are measured in dollar terms. If money values have not been assigned to inputs and outputs then these can be determined in some fashion.

Cost effectiveness = cost of program / effect of program on a common measure

There are many different types of cost analyses. Cost feasibility is straightforward and answers the question of whether we have sufficient funds or resources. Cost effectiveness looks at the cost per unit and an example of this is to calculate the return on training investment. For example, Federal Express reported a 24% return on training investment over a period of three months for a program which gave 20 new employees training in driving company vans. Finance and engineering specialists allocated dollar values to the performance categories and performance was compared to an "untrained" control group[16]. Cost-benefit analyses can be used to contrast the proposed advantages and disadvantages and a cost-utility analysis can be used routinely to make comparisons in the ultimate value of what you are trying to achieve.

Step 4 – Did the program or service achieve its key objective(s)?

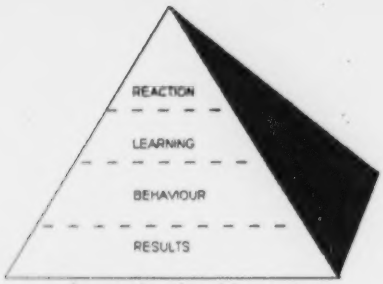
The focus of this question is to concentrate your attention on the key objectives of your program. To what extent were you able to achieve these outcomes? Here we are focusing on the gross outcomes or effects of the program,

Surveys of training and education experiences have indicated that 63% of in-house and external training programs in Australia failed even to assess learning. Some say that you do not really need to assess learning because it is obvious. Well, official figures indicated that some 400,000 of the 3 million people who undertook training programs in Australia reported *that training had not improved job performance*. It may have been a satisfactory experience and learning may have occurred (either short-term or long-term); but sadly, we shall never know[17].

A peculiar difficulty in educational evaluations is separating out the short- from the long-term effects of education. You may have had the experience that some education and training programs are evaluated positively by participants but have few long-term effects while others might not be evaluated well in the short-term but have significant long-term effects. This placebo effect of any training program should not be overlooked.

Evaluations of computer-assisted learning across some 180 studies[18] indicated that average performance in examinations is raised by around 11 percentile points and affected attitudes to instruction, towards computers but not towards subject matter.

A multi-dimensional approach that offers a straightforward, pragmatic and initial basis for an educational evaluation is Kirkpatrick's hierarchy of evaluation[19]. This is a comprehensive approach to evaluation that has been around for many years and which is popular in adult education and training. It focuses on four levels of program outcome and is illustrated in the figure below. It is especially suited to training contexts where specific outputs are of interest right from the outset. It is a pity, therefore, that the four levels of program outcome are not used more often.



An evaluation hierarchy

I. Reaction - eg, program participants' estimates of satisfaction provide an immediate level of evaluation
II. Learning - eg, the extent of learning (ie, skill acquisition, attitude change) that has been achieved is also of interest
III. Behaviour - eg, the extent to which learning has generalised to the work situation or there has been a transfer of skills is assessed at this level through follow-up after a program
IV. Results - eg, the wider impact of a program in the community or the organisation is observed at this level in the hierarchy.

Most people undertake the evaluations of courses only at Level 1 through the use of end-of-course questionnaires. This is helpful but is only part of the picture. At the very least, the questionnaires need to be standardised, comparable with other databases of results, anonymous and processed independently. My opinion is that *all* course participants should be assessed at level 1. Depending on the size of the group, course participants could evaluate either (a) the quality of the training or instruction; (b) the curriculum or content; or (c) the overall course. Further random samples should be taken to assess the effect of training at Levels 2 (say 80% of course participants over time where numbers are less than 300), with smaller group samples at Levels 3 and 4. In conducting these surveys I recommend the benefits of matrix sampling (ie, asking different questions to individuals and combining results for the group) rather than asking every person every question.

The simplicity of the model masks some real complexities in evaluating the extent to which skills, knowledge and attitudes have been acquired, retained and maintained. You should also be aware that there are criticisms of this approach[20] but it has served as an influential catalyst for training evaluation.

Step 5 - What is the net effect of the program or service?

A challenge for any evaluator is to determine the effectiveness of his/her program or service and to contrast this with comparable programs. This means that we need to be able to describe the impact of a program, its significance and the size of any learning effect. Firstly, the net outcome must be established and it is not always the case that significant differences in test scores are evident when multimedia is compared with traditional instruction, for example in university tutorials on telecommunications,[21] but may be evident in other characteristics such as attitudes. One of the advantages that have been claimed for multimedia in language instruction are its ability to facilitate learning but also enhance student attitudes or motivation to learn.[22]

We also might want to analyse the differential impact that training is having for various groups and some analytical framework is helpful. I would refer you to almost any textbook on research designs for some help in selecting the most appropriate method of analysis or design. Without comparisons, however, it is impossible to make any statement about value. This is because program evaluation is largely a relative process.

Then again, another factor in making comparisons is how training can interact with the pre-existing skill level and expertise of the participants. An excellent example from one of my graduate students might help here. Three groups of nurses (community nurses, ward staff, new graduates) had largely identical scores on a pre-test knowledge of drug and alcohol. Following training the follow-up assessments after some 2-3 months indicated the greatest training gains in knowledge (on a 25-item test) for the most experienced nursing staff ($F(2,42) = 10.2$, $p<0.0002$). There were significant gains in training but these varied

across the levels of experience. This type of outcome would be familiar to experienced trainers and it highlights the need to make comparisons.

GROUP	Pre-test Mean score (SD)	Post-test Mean score (SD)
New graduates	13 (4)	16 (3)
Ward staff	14 (3)	19 (3)
Community nurses	14 (4)	20 (2)

Note: All scores rounded

Step 6 - To what extent have the perspectives and interests of all stakeholders been considered and met?

Although our programs and services may be well-intentioned they may overlook the interests or needs of client groups. For instance, Medtronic is a company that operates in the area of implanted heart devices; it uses multimedia to increase learning and reduce training time but it found that the introduction of multimedia had to overcome resistance from its sales representatives[23].

The value of client consultation cannot be overemphasised because it alerts you to factors that you may not have considered important. Stakeholder perspectives are many and varied (eg, participants, staff, management, community, government) and some of the questions that you may wish to consider, could include

- Why was the program, policy or initiative introduced?
- What are its intended educational outcomes?
- How do people feel about the program?
- Who are the key stakeholders?
- What are the social costs and benefits of the program?
- What constraints are operating?
- How will the evaluation findings be used?

It should not be a surprise that corporations with the best training evaluation process (eg. IBM, Motorola University, Arthur Andersen, Florida Power, and AT&T's School of Business) have a customer focus[24]. They determined client requirements: "Well over half of what IBM identified as customer requirements had not been previously measured by the training unit". The term "customers" relates directly to stakeholder perspectives and included participants, their managers, external customers, training councils, vendors, regulatory agencies, and upper-level management.

Conclusions

These six questions synthesise the educational evaluation process for me and I hope that they provide a brief but comprehensive framework within which you can operate. I think that they cover the most important issues, when you are ready to undertake an evaluation of any program or service. The six steps and some of the criteria are summarised in the checklist below. These steps, however, do not provide an automatic answer.

The results form the basis for a decision about the worthiness of the program or service. With all the information from these six steps, you then have to decide whether the program has merit. In some cases a program may be costly but very effective; or it may be effective in the short-term and well-liked but may not be meeting long-term needs; or it may be less than perfectly ethical but have wide coverage and popularity; and so on. You will bring to the evidence a set of priorities, which must ultimately influence any decision. That is fine and it is exactly the way it should be - there is no 'right' answer.

Some criteria will be more relevant to you than others but all need to be weighted appropriately for your decision. Such decisions involve complex judgements about each educational program or service. Maybe the best that we can hope for is to provide information that confirms our ideas about the potential of a program or that refutes claims about the value of a program. In this way educational and training evaluations will add to our store of knowledge about what works and what does not work in education and training and how well it works.

To return to the perceived barriers for evaluation, firstly it is clear that evaluation does require expertise but that it can be acquired. It is not overly complex and is an inter-disciplinary field in which I would encourage your greater involvement (eg. through your own profession or specialist organisations such as the Australasian Evaluation Society). Secondly, many of the difficulties in evaluation, such as the lack of standards or the difficulty in isolating behaviours often relate to the ways in which programs were established and conceived at the outset. You may need to set your own standards and define the behaviours that you consider most important. Thirdly, the difficulties in measurement can be overcome by having well-stated and specific learning outcomes which are few in number. Qualitative training outcomes can be described using case studies or what we call ethnographic approaches that yield valuable descriptions. Fourthly, the issue of insufficient staff might be considered from the viewpoint of building evaluation into every training component from the outset. The easiest evaluations to conduct are those in organisations that keep excellent records or have set up mechanisms for program monitoring. It is not possible to make education or training perfect but over time it is possible to reduce our errors through practical training evaluations and to improve gradually the quality of our professional efforts.

Acknowledgement

An earlier version of this paper was presented at the IQPC Technology-Assisted Learning Conference, Melbourne 1998. Sections of this paper have also been taken from Athanasou, J A (1998) A framework for evaluating the effectiveness of technology-assisted learning. *Industrial and Commercial Training, 30*, 96-103; and Athanasou, J A (in press), Evaluating adult education and training. In Foley, G (Ed.), *Understanding adult education and training (2nd ed.)*, Sydney: Allen & Unwin.

Table 2 Checklist for holistic evaluations of training services

Issue 1 - Is the program or service ethical?
Ethics/morality
Social and political implications
Legality
Any harmful ecological issues
Any impact on privacy or confidentiality
Any abuse of privilege
Reasons for the evaluation
Whether human ethical guidelines have been satisfied
Whether evaluation standards have been satisfied
Issue 2 - To what extent does the program or service cover those who are most in need?
The incidence of the educational or training need
The numbers of people who are at risk
The prevalence of the educational or training need
The numbers of people who are at risk
The sensitivity of the program
The specificity of the education or training
The attendance and completion rates for any course
Issue 3 – What are the costs, benefits and utilities of the program or service?
Cost feasibility
Cost effectiveness
Cost-utility
Cost-benefit
Issue 4 – Did the program or service achieve its key objective(s)?
Reactions
Learning
Behaviours
Results
Issue 5 – What is the net effect of the program or service?
Comparison with other programs
Comparison with pre-determined standards
Determine statistical effect size (if relevant)
Issue 6 – To what extent have the perspectives and interests of all stakeholders been considered and met?
Why was the program, policy or initiative introduced?
What are its intended educational outcomes?
How do people feel about the program?
Who are the key stakeholders?
What are the social costs and benefits of the program?
What constraints are operating?
What aspects will influence decision-making?
How will these evaluation findings be used?

Source: Adapted from Athanasou (1998a), p. 102

---

[1] Behrendt, E. & Hakenberg, P. (1996). Training while in employment of unskilled and semi-skilled workers: The "Training Drive '95" launched by the Ford factory in Cologne. *Vocational Training European Journal, 8-9*, 91-97.

[2] Baggott, L.M. & Wright, B. (1996). PhotoCD in biology education. *American Biology Teacher, 58*, 390-95.

[3] Collis, B. (1996). Does more technology mean more choice for the learner? Experiences from the Telescopia project. *Vocational Training: European Journal, 7*, 12-19.

[4] Steeples, C. (1993). A computer-mediated learning environment for adult learners: Supporting collaboration and self-direction. *Journal of Educational Multimedia & Hypermedia, 2*, 443-454.

[5] Beeton, D. & Duguid, A. (1996). Good and bad use of open and flexible learning: Findings of recent UK case studies. *Vocational Training: European Journal, 7*, 8-11.

[6] Sources: Australian Bureau of Statistics, *Training Practices – Australia 1994*, Catalogue No. 6356.0 and *Employer Training Expenditure, Australia July-September 1996*, Catalogue No. 653.0.

[7] Baumgartner, L., Stenersen, S. & Campbell, K. (1996). Overcoming barriers to evaluating health education and training programs. *Evaluation and the Health Professions, 19*, 292-310.

[8] Johnson, T.R. & Geller, D.M. (1992). Experimental evidence on the impacts of computer-aided instruction in the Job Corps program. *Evaluation Review, 16*, 3-22.

[9] Lawless, K.A. & Brown, S.A. (1997). Multimedia learning environments: Issues of learner control and navigation. *Instructional Science, 25*, 117-131.

[10] Morris, L. (1994). To evaluate or not to evaluate. *Training & Development, 48*, 62

□

[11] The object of an evaluation is not the objective but what is being evaluated. It includes - educational and training programs, projects, materials and programs.

[12] An evaluation of adult education and training can take many forms. It can be formal or informal in nature (ie for organisational or personal use); it can be internal or external (ie, conducted by yourself or consultants); formative or summative. A formative evaluation is conducted during a program in order to bring about changes, if required; a summative evaluation summarises evidence and occurs mainly at the conclusion of a program.

[13] Moreover, computer-assisted learning should be clarified; it can involve anything from drill and practice, through to tutorials, simulations, creating models, interactive systems, information resources, or data processing.

[14] Incidence: the flow of new clients or the number of new people with a problem (eg, new recruits, newly promoted managers requiring to be trained). Prevalence: the rate of occurrence of a problem (eg, extent of persons with lower than average skills). At risk: the potential group of persons who might be likely to encounter a problem (eg, the number of staff with poor completion rates for alternative methods of instruction). Sensitivity of a program: the adequacy of the criteria used to identify the appropriate persons covered by a program (eg. sensitivity of a screening test to identify persons with learning disabilities). Specificity of a program: the adequacy of the criteria used to exclude or reject those unlikely to benefit from a program (eg. value of a selection test to diagnose those unlikely to benefit from training).

[15] The formula for coverage efficiency comes from Rossi, P.H. & Freeman, H.E. (1993). *Evaluation. A systematic approach.* Newbury Park: Sage, p.179

[16] Phillips, J. J. (1996). Was it the training? *Training & Development. 50*, 28-32.

[17] Athanasou, J.A. (1997). Testing competency in a high tech learning environment, *Training and Development in Australia*, (in press). (Source: Australian Bureau of Statistics, Training and Education Experience – Australia 1993, Catalogue No. 6278.0)

[18] Kulik, J.A. & Kulik, C-I, C. Review of recent research literature on computer-based instruction, *Contemporary Educational Psychology*.

[19] Donald L. Kirkpatrick (1996). *Evaluating Training Programs: The Four Levels*. San Francisco, CA:Berret-Koehler Publishers

[20] Bernthal, P.R. Evaluation that goes the distance. *Training & Development. 49*, 41-45.

[21] Yaverbaum, G.J. & Nadarajan, U. (1996). Learning basic concepts of telecommunications: An experiment in multimedia and learning. *Computers and Education, 26*, 215-224.

[22] Brett, P. (1996). Using multimedia: An investigation of learners' attitudes. *Computer Assisted Language Learning, 9*, 191-212.

[23] Webb, W. High tech in the heartland. *Training, 34*, 50-52.

[24] Dixon, N. M. (1996). New routes to evaluation. *Training & Development.* 50, 82-85

Occasional Papers

No. 1. Vocational achievements following spinal cord injury in Australia, August, 1994

No 2. Validity of self-estimates of career interests under matching and non-matching conditions, September 1994

No. 3. Combining school and work - new pathways for learning in Australia, October 1995

No. 4. Examining the validity of Azrin's Job Club methodology as a way of increasing job seeking behaviour and vocational achievements of unemployed persons with spinal cord injury: a case study, February 1996

No. 5. Evaluating the effectiveness of multimedia based learning, July 1998

This report is a draft for inter-office circulation. Comments and criticisms are invited.
Contact address: Dr James A Athanasou, Faculty of Education, University of Technology, Sydney, PO Box 123, Broadway, 2007. Tel. (02) 9514-3712 Fax (02) 9514-3939 E-mail: J.Athanasou@uts.edu.au